U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: AIRPLANE SIMULATOR QUALIFICATION

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Change: 2

1. PURPOSE. This Change transmits Appendix 5, Windshear Qualification. The appendix applies to all simulators used to satisfy the training requirements of FAR Part 121 pertaining to the certificate holder's approved low-altitude windshear flight training program.

The Change number and date of the changed material are carried at the top of the page.

2. PRINCIPAL CHANGES. This appendix provides guidance for qualification of flight simulators for required flightcrew windshear training.

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Director, Flight Standards Service

APPENDIX 5. WINDSHEAR QUALIFICATION

1. APPLICABILITY. This appendix applies to all simulators used to satisfy the training requirements of FAR Part 121 pertaining to the certificate holder's approved low-altitude windshear flight training program.

2. STATEMENT OF COMPLIANCE. A statement of compliance is required to include the following:

a. Documents that the aerodynamic model is based on airplane data supplied by the airplane manufacturer, or other named source, and that any change to environmental wind parameters, including variances in those parameters for windshear conditions, once inserted for computation, should result in the correct simulated performance.

b. Examples where environmental wind parameters are currently evaluated in the simulator (i.e., crosswind takeoff, crosswind approach, or crosswind landings, etc.).

3. QUALIFICATION BASIS. The addition of windshear programming to a simulator in order to comply with the qualification for required windshear training does not change the original qualification basis of the simulator.

4. MODELS. The windshear models installed in the simulator software that will be used for qualification evaluation must:

a. Provide cues necessary for recognition of the onset of a windshear phenomena and potential performance degradation that would require a pilot to initiate recovery procedures. The cues must include one or more of the following, as may be appropriate:

(1) Rapid airspeed change of at least ±15 knots.

(2) Stagnation of airspeed during the takeoff roll.

(3) Rapid vertical speed change of at least ±500 feet/per minute.

(4) Rapid pitch change of at least ±5°.

b. Be adjustable in intensity (or other parameter to achieve the desired effect) so that after encountering and recognizing the windshear, and with the application of recommended procedures for escape from such a windshear, the following results may be achieved:

(1) The performance capability of the simulated airplane permits the pilot to maintain a satisfactory flightpath.

(2) The performance capability of the simulated airplane does not permit the pilot to maintain a satisfactory flightpath (crash).

c. Be available for use in the approved windshear flight training program. The means used to accomplish the "nonsurvivable" scenario of paragraph 4b(2), which involve operational elements of the simulated airplane, must reflect parameters which fall within the dispatch limitations of the airplane.

5. TESTS.

a. The operator should identify two of the required training windshear models (one takeoff and one approach) to be demonstrated for Approval Test Guide (ATG) purposes and should define the wind components of these two models for the survivable scenario. This definition should be presented in graphical format

so that all components of the windshear are shown, including initiation point, variance in magnitude, and either time or distance correlation as may be appropriate. The simulator must be operated at the same gross weight, airplane configuration, and initial airspeed in both of the following situations for the two models selected (total of four tests):

(1) Through calm air.

(2) Through the selected survivable windshear.

b. In each of these four situations, at an "initiation point" (that point being where the onset of windshear conditions is, or would have been recognized, depending on the test being run), the recommended procedures for windshear recovery shall be applied, and the results shall be recorded, as specified in paragraph 6. These recordings shall be made without the presence of programmed random turbulence and, for the purposes of this testing, it is recommended, although not required, that the simulator be flown by means of the simulator's autodrive function (for those simulators that have autodrive capability) during the tests. Turbulence which results from the windshear model is to be expected, and no attempt may be made to neutralize turbulence from this source.

6. RECORDING PARAMETERS.

a. In each of the four ATG cases, an electronic recording (time history) must be made of the following parameters:

(1) Indicated or Calibrated Airspeed.

(2) Indicated Vertical Speed.

(3) Pitch Attitude.

(4) Indicated or Radio Altitude.

(5) Angle of Attack.

(6) Elevator Position.

b. These recordings shall be initiated at least 10 seconds prior to the initiation point and continued until recovery is complete or ground contact is made. For those simulators not capable of electronic recording of the above parameters, video recordings which have been cross plotted into a time history format will be considered an acceptable means of data presentation. If data of sufficient resolution for elevator position is not obtainable using this method of video cross plotting, then stick position may be used. Special, temporary instrumentation readout installations may be required to record these parameters on video tape.

7. EQUIPMENT INSTALLATION. For those simulators where windshear warning, caution, or guidance hardware is not provided as original equipment with the airplane, and, therefore, subsequently added to the airplane and simulator, a statement of compliance is required stating that the simulation of the added simulator hardware and/or software, including associated cockpit displays and annunciations, functions the same or equivalent to the system(s) installed in the airplane. This statement shall be supported by a block diagram describing the input and output signal flow and comparing it to the airplane configuration.

8. APPROVAL TEST GUIDE (ATG).

a. The operator must develop the statement of compliance, accomplish the performance determination and recording, and forward the resulting information to the National Simulator Program Manager (NSPM) at the following address:

Federal Aviation Administration
National Simulator Program Manager, AFS-205
3400 Norman Berry Drive
East Point, GA 30344
Telephone (404) 763-7773

When it is received and accepted, the NSPM will return the package to the operator with instructions to include the information in the ATG.

b. The simulator will be scheduled for an evaluation in accordance with normal procedures. Use of recurrent evaluation schedules will be used to the maximum extent possible.

c. During the onsite evaluation, the evaluator should ask the operator to run the performance tests and record the results. The results of these onsite tests will be compared to those results previously approved and placed in the ATG.

d. ATG's for new or upgraded simulators shall contain or reference the information described in paragraphs 2, 4, 5, 6, and 7 of this appendix as may be appropriate for the simulator.

9. FUNCTIONAL EVALUATION. A simulator evaluation specialist must fly the simulator in at least two of the available windshear scenarios to evaluate subjectively the performance of the simulator as it encounters the programmed windshear conditions according to the following:

a. One scenario will include parameters that enable the pilot to maintain a satisfactory flightpath.

b. One scenario will include parameters that will not enable the pilot to maintain a satisfactory flightpath.

c. Other scenarios may be examined at the discretion of the simulator evaluation specialist.

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